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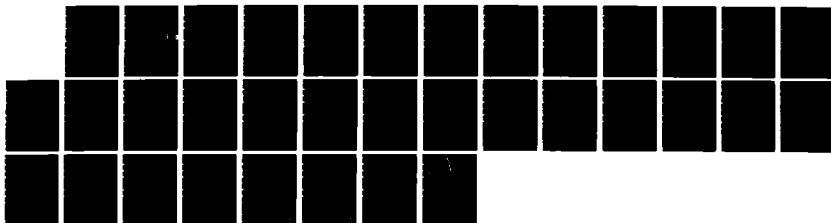
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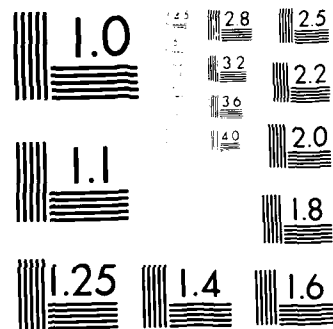
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AIR FORCE INTEGRATED READINESS MEASUREMENT SYSTEM (AFIRMS)

**ANALYSIS OF STRATEGIC AIR COMMAND (SAC)
CAPABILITY ASSESSMENT METRICS**

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SECTION 1. INTRODUCTION

1.1 Purpose. This report is based on a study performed by SofTech in July and August of 1985. This study is the initial phase of a requirements analysis effort to tailor AFIRMS to the needs of Strategic Air Command (SAC). The SAC requirements analysis is a small part in the development of the Air Force Integrated Readiness Measurement System (AFIRMS), a summary of which appears below. The purpose of this report is to discuss the choice of a capability assessment metric, or unit-of-measure, for SAC. Prior to July 1985, a Learning Prototype Phase (LPP) tested the basic concepts of AFIRMS on an experimental testbed system which linked a base, a Major Command (MAJCOM), and Headquarters, United States Air Force (HQ USAF). That phase focused on the tactical fighter environment at Headquarters, United States Air Forces in Europe (HQ USAFE) and Spangdahlem Air Base.

This study, and a concurrent study of Military Airlift Command (MAC) broaden the base upon which AFIRMS rests. This base will support the definition and design phase of AFIRMS development.

1.2 Key AFIRMS Concepts. AFIRMS is an automated, tasking based, capability assessment system. As such, AFIRMS evaluates unit and force capability to perform tasked missions based on the availability of specific resources.

a. The conceptual requirements for AFIRMS are two-fold:

- (1) Assessment of combat capability against specific tasking. The user can assess unit/force combat capability against any planned or ad hoc tasking, e.g., War Mobilization Plan (WMP), Operation Plan (OPlan), Fragmentary Order, Air Tasking Order (ATO), Contingency Plan, etc.
- (2) Assessment of combat capability based on budget appropriations. AFIRMS provides a tool for computing long-term readiness and sustainability trends, spanning two to six fiscal years. This tool permits comparison of readiness and sustainability by fiscal year and can therefore highlight the impact of appropriation changes. Thus, changes in funding are related to changes in force readiness and sustainability. Also, senior Air Force decision makers are supported during budget deliberations and Air Force budget allocations.

b. AFIRMS implementation has two key concepts:

- (1) Integrated approach to tasking based capability assessments. AFIRMS has two integrative dimensions. First, all applicable resources and their usage interactions are considered. For example, in sortie capability assessment, AFIRMS evaluates capability in terms of all four essential resource types (aircrew, aircraft, munitions, fuel), their interdependencies, and their generative components (such as spares for aircraft, training qualifications for aircrew, load crews for munitions, and hot pits for fuel). Second, other automated systems (such as the Combat Supplies Management System (CSMS), Combat Fuels Management System (CFMS), Weapon System Management Information System (WSMIS), etc.) outputs are integrated into capability assessment calculations through system interfaces between those systems and AFIRMS.
- (2) Data Quality Assurance. Capability assessment is no better than the data upon which it is based. Therefore, AFIRMS emphasizes a user orientation toward quality assurance of source data. Unit and other data input level users are provided effective tools to accomplish their daily activities and therefore develop a vested interest in AFIRMS data currency and validity. Capability assessment data can then be extracted for use by higher or parallel users with maximum confidence in its validity.

1.3 AFIRMS Functions. Four basic AFIRMS functions combine to assess readiness capability:

- a. Translate Tasking. As a tasking based capability assessment system, tasking must be converted into a standard format recognized by AFIRMS. Tasking is defined in AFIRMS to the unit level and may consist of actual, hypothetical, standard, or contingency tasking. Any of these taskings can be defined within specified WMP or OPlan constraints, at the option of the user. Likewise, the tasking may be defined by the user for present, historic or future requirements.
- b. Define Resources. The resource definition function of AFIRMS ensures that information about inventory status is available and accurate. Wherever possible, this data is obtained by interface with other functional systems. As with tasking, resource information can be defined for actual, hypothetical, standard, or contingency situations, either present, historic, or future.
- c. Determine Ability to Perform. Determining the force's ability to perform is the essential function of AFIRMS. The tasking and resource data are processed to determine how much of the specified tasking can be accomplished with the resources available. Ability to perform is evaluated in terms of the task metric (missions, sorties,

etc.) and the cost metric (dollars) to provide readiness/sustainability and dollars to readiness assessments.

- d. Aggregate, Analyze and Present Data. Aggregation, analysis and presentation ensure the proper grouping and display of information to provide useful information at the unit, major command and HQ USAF. Aggregation refers to the creation of a composite understanding of capability for several units.

1.4 References.

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- d. Strategic Air Command (SAC) AFIRMS Requirments Analysis, SofTech, Inc., 30 September 1985.
- e. A Concept for the Management of Readiness, Logistics Management Institute, Washington, D.C. 20016, January 1980, DoD Contr. No. MDA903-77-C-0370.
- f. Force Projection/Aerial Refueling Air Force Wide Mission Area Analysis (AFWMAA) Mission Area Analysis Decision Support System (MAA/DSS) Functional Description, Working Draft, Mid-May 1985, ANSER, Arlington, VA (for AF/XOXR).
- g. Joint Chiefs of Staff memorandum of Policy No. 172 (JCS MOP 172), 2nd Revision, Military Capability Reporting, 1 June 1982.
- h. PACCS Airborne Alert Sustainability (U), Rand Corporation, February 1985, Contr. No. N-2171-AF (Secret).
- i. SACR 55-7, Vol. 1, SAC EWO Planning (Aircraft) (U), dated 15 June 1985.
- j. SAC Unit Designed Operational Capability (DOC) Statements, AF/XOOIM.
- k. USAF War Mobilization Plan, Volume 5 (WMP 5), AF/XOXIC.

1.5 Acronyms.

ACCS	Airborne Command and Control Squadron
AFIRMS	Air Force Integrated Readiness Measurement System
ATO	Air Tasking Order
BW	Bomb Wing
CFMS	Combat Fuels Management System
Cmd	Command
CSMS	Combat Supplies Management System
DG	Defense Guidance
DOC	Designed Operational Capability
FMIS	Force Management Information System
HQ USAF	Headquarters, United States Air Force
HQ USAFE	Headquarters, United States Air Forces in Europe
ICBM	Intercontinental Ballistic Missile
JCS	Joint Chiefs of Staff
LPP	Learning Prototype Phase
MAA	Mission Area Analysis
MAC	Military Airlift Command
MAJCOM	Major Command
NCA	National Command Authorities
NEACP	National Emergency Airborne Command Post
OJCS	Organization of the Joint Chiefs of Staff
OPlan	Operations Plan
ORI	Operational Readiness Inspection
PACCS	Post Attack Command Control System
SAC	Strategic Air Command
SACCS	SAC Automated Command Control System
SIOP	Single Integrated Operations Plan
SMW	Strategic Missile Wing
USAF	United States Air Force
WMP	War Mobilization Plan
WSMIS	Weapon System Management Information System

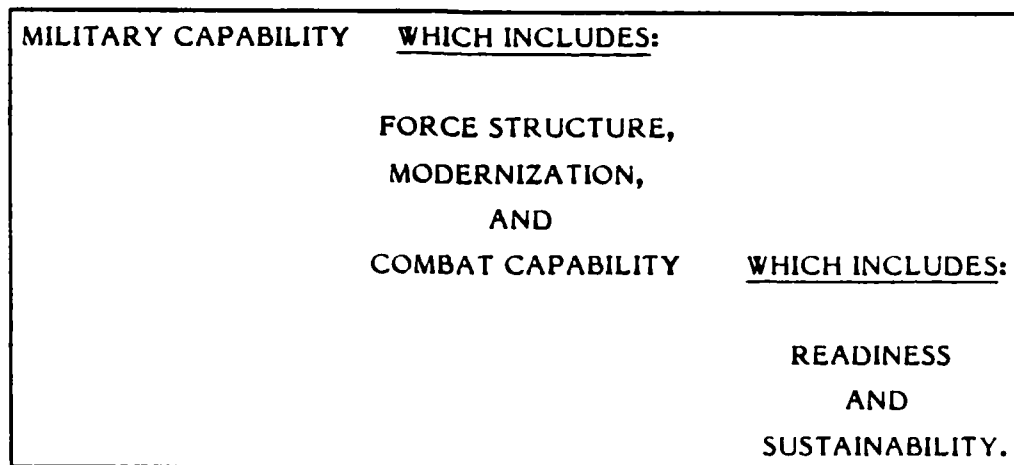
SECTION 2. CAPABILITY ASSESSMENTS

Two types of capability are recognized, one of which is a component of the other. Combat capability consists of readiness and sustainability. It is a component of military capability which also includes force structure and modernization. AFIRMS will assess the unit's combat capability to perform a specific task. A discussion of some issues in determining units of measure are included in Appendix A.

2.1 Capability Relationships. Table 2-1 summarizes the relationships among the elements of Military Capability as defined in Joint Chiefs of Staff (JCS) Memorandum of Policy No. 172 (MOP 172). Definitions of the terms appear in Section 2.2. AFIRMS is concerned with combat capability, but we identify all elements of military capability to establish a basis for defining a proper metric for AFIRMS.

Table 2-1

ELEMENTS OF CAPABILITY



2.2 Definitions of Capability Terms.

- | | |
|---------------------|---|
| Combat Capability | - The readiness status of a unit to perform its tasked combat mission and its ability to sustain a required level of tasking for a specified number of days. The terms "Combat Capability" and "Readiness and Sustainability" are used interchangeably throughout the AFIRMS documents. |
| Military Capability | - The ability to achieve a specified wartime objective (win a war or battle, destroy a target set). Its components are: Combat Capability (that is Readiness and Sustainability), Force Structure, and Modernization. |
| Force Structure | - Numbers, size, and composition of the units that comprise our defense forces, e.g., divisions, ships, airwings. |
| Modernization | - Technical sophistication of forces, units, weapon systems, and equipment. |
| Readiness | - The ability of our forces, units, weapon systems, or equipment to deliver the outputs for which they were designed (includes the ability to deploy and employ without unacceptable delays). |
| Sustainability | - The "staying power" of our forces, units, weapon systems, and equipment, often measured in numbers of days. |

2.3 The Type of Capability Measured. AFIRMS is not chartered to measure Military Capability. If it were, it would have to measure "ability to achieve a specified wartime objective," most probably as seen in the ability to destroy a target set." In other words, force modernization and force structure are not included in the AFIRMS capability assessment.

Instead, AFIRMS evaluates Readiness and Sustainability, two of the four components of Military Capability. This subdivision permits analysis and measurement of the components of Combat Capability with an accuracy and precision not possible for all of the Military Capability Components. However, even the statement that AFIRMS deals with Readiness and Sustainability (or Combat Capability) does not fully clarify the issue.

For example, Readiness is defined as "The ability...to deliver the outputs." Three possible interpretations of those words have been considered in AFIRMS. Two of the interpretations are rejected as outside the AFIRMS scope of readiness or sustainability:

- Mission completion, i.e., penetrate to the target and return:
 - survival
 - launch
 - penetration
 - offload fuel, release weapons
- Mission results, i.e., target destroyed.

Instead, AFIRMS assesses the unit's ABILITY TO LAUNCH the mission tasking AND SUSTAIN THE LAUNCHING of the mission tasking for a specified number of days. Thus, AFIRMS concerns itself with factors such as missions, sorties, or flying hours. This decision leaves to other systems the evaluation of the quality of mission accomplishment. This study is directed to establishing which data items should be counted at the "launch" level to effectively state the Readiness and Sustainability of SAC.

2.4 The AFIRMS Approach to Capability Measurement. AFIRMS capability assessment is, by definition, tasking based. The intent is to measure the extent to which a specified unit or force can launch and sustain its mission tasking. This approach has two major advantages:

- It addresses the central concern of commanders, i.e., "what is my unit's ability to perform the assigned task?"
- It provides a basis for integrating all the needed resources (e.g., aircraft, aircrew, etc.) rather than viewing them individually, or in small groups, as is done by traditional inventory systems.

The AFIRMS approach leads directly to a focus on the tasking for the first day when discussing readiness and to a focus on the tasking over a period of days when discussing sustainability. This approach also suggests that the proper metric(s) for AFIRMS is:

- The unit-of-measure in which tasking is stated, e.g., mission, sortie;
- A translation of the unit-of-measure in which tasking is stated, e.g., flying hours, sortie rate.

Another aspect of AFIRMS is significant in the consideration of metrics. AFIRMS does not want to collect data that is already captured or computed. Wherever the needed data is available, in detail and in a form usable by AFIRMS, the AFIRMS program is committed to use that data as developed by existing or future systems, e.g., Strategic Air Command Control System (SACCS), Force Management Information System (FMIS), etc. The use of appropriate metrics which are already computed by other systems is in complete agreement with the AFIRMS concept (reference Section 1.2.b(1)).

Additionally, AFIRMS assesses capability at the unit level where aggregation of resources does not conceal distributional problems. (AFIRMS attempts to avoid the error of assuming that a wing short of aircrews and another wing with more than enough aircrews equal two wings with enough aircrews.) At the same time, AFIRMS must ultimately report on the total capabilities of the Air Force. Thus, the metric chosen need not be the same at all command levels, but must be one which allows for aggregation from unit level to a higher command level.

SECTION 3. SAC MISSIONS AND METRICS

The primary mission of the Strategic Air Command (SAC) is to conduct strategic offensive warfare as tasked by the Single Integrated Operations Plan (SIOP).

To conduct strategic air warfare, SAC has:

- Strategic Missile Wings (SMW) with intercontinental ballistic missiles (ICBM);
- Bomb Wings (BW) with B-52, FB-111A, and B-1B bombers.

To support the strategic offense mission, SAC has:

- Air Refueling units with KC-135 and KC-10A aircraft (the KC-10A units also have a strategic airlift mission),
- Strategic Reconnaissance units with RC-135, U-2, and SR-71 aircraft,
- A Tactical Reconnaissance unit with TR-1A aircraft, and
- Airborne Command and Control units with EC-135 and E-4 aircraft.

The missions of the above SAC units are discussed in the following sections with respect to the relationship of the mission to the metric. The missions are discussed in the following order:

- Strategic Offense (i.e., Intercontinental bombardment)
- Air Refueling (i.e., airborne transfer of fuel between aircraft)
- Strategic Airlift (i.e., air movement between theatres)
- Reconnaissance (i.e., Strategic and tactical reconnaissance)
- Airborne Command and Control (i.e., airborne command post, force connectivity)

The term "mission" has two meanings in the Air Force and in this report. The mission, when used as a metric, uses the the second definition.

- (1) A mission is an operational or specialized task categorized by objective (e.g., Airlift, Strategic Offense, Air Refueling, etc.) and/or perspective (e.g., strategic, tactical).

- (2) The mission is also a dispatching of one or more aircraft (or missiles) to accomplish one particular task. An aircraft dispatched on a mission may fly one or more sorties; each sortie may be one or more hours in duration. In addition, an aircraft assigned to a mission may not fly but, instead, be on a ground alert for the mission. (A ground alert aircraft or missile is fully generated for flight but is held on the ground ready for an immediate launch on its assigned mission/task).

The term "sortie" also needs to be defined. The "sortie" has one meaning in the Air Force and in the Joint Chiefs of Staff dictionary (JCS Pub 1):

A "sortie" is an operational flight by one aircraft (or missile).

However, to distinguish between the two types of sorties possible for a mission (i.e., a "flying" sortie or ground "alert" sortie but not both on one mission), an "alert sortie" will be defined as:

An aircraft or missile on ground alert (i.e., the sortie is generated but not launched).

3.1 Strategic Offense. Strategic offense is the use of strategic offensive forces to attack enemy military forces and installations, and its industrial capability to sustain war. The forces may be employed across theatre lines or be limited to a single theatre, may employ conventional or nuclear weapons, and will use manned or unmanned delivery systems.

3.1.1 Strategic Missiles. The primary weapon system of the Strategic Missile Wings is the LGM-30F/G (Minuteman II/III). The old LGM-25C (Titan II) missile is being deactivated and will be removed from the Air Force inventory by 1987. The new LGM-118A (Peacekeeper or MX) will number only 50 launchers.

3.1.1.1 Organization and Tasking. There will be six Strategic Missile Wings (SMW) at six bases (after the Titan missiles are deactivated), of which, only three are not collocated with a bomber wing. Each wing is equipped with 100 to 180 ICBMs and their sole tasking is the SIOP. The tasking is already known to the unit and is updated as changes occur. The tasking is based on the number of missiles authorized to the unit. The United States Air Force (USAF) War and Mobilization Plan (WMP) and unit Designed Operational Statement (DOC) do not task the unit for sorties or flying hours.

3.1.1.2 Capability Assessment. The unit is tested by the SAC Inspector General with unit Operational Readiness Inspections (ORIs) to verify that the unit is capable of launching the alert missile force (i.e., the missiles are operational and are ready to be launched to support the tasked missions) and generating all missiles for the SIOP.

The missile unit's capability assessment in AFIRMS will be a straight forward computation and will be easier than the flying units in that the missiles can not be recycled into follow on missions. In addition, the missile unit capability assessment can be aggregated into a capability assessment for higher command echelons (i.e., SAC's strategic missile capability is the sum of the missile wings' capability).

3.1.1.3 AFIRMS Metric. The proposed AFIRMS capability assessment metric for Strategic Missile Wings is mission with alert sortie as the alternate metric. The advantages and disadvantages of each metric are discussed in Section 3.6.

3.1.2 Strategic Bombers. Strategic bomber weapon systems are the B-52G and H, the FB-111A, and the new B-1B.

3.1.2.1 Organization and Tasking. Strategic Bombardment Wings typically have 1 or 2 B-52/FB-111A bomb squadrons and 1 or 2 air refueling squadrons of KC-135 tankers. Some bomber and tanker aircraft are on SIOP alert at all times. One (soon to be two) bomb wing is primarily tasked in the conventional role. If more aircraft are needed, other bomb wings may contribute to the conventional bombing force depending on the direction from the Organization of the Joint Chiefs of Staff (OJCS). Bomb wings that are released from the SIOP tasking to a conventional tasking are always subject to recall to the SIOP task when needed.

Because of the SIOP tasking, strategic bombers do not typically deploy as a unit (the exception would be those primary bomb squadrons tasked for the conventional role). When a bomber force must be deployed overseas to support a theatre commander, the aircraft and aircrews are pulled from several wings to make up a provisional strategic bomber force. Because of the SIOP, SAC does not release the bomber force to the operational control of the theatre command but, instead, deploys a command element to the theatre to control and task the bomber force for the theatre command. (SAC keeps two command elements in-place for the major theatres, 7th Air Division in Europe and 3rd Air Division in the Pacific.)

The SIOP tasking is preplanned missions and is not often changed. Because of the nature of nuclear warfare, the predominant concern is with the initial mission. Any follow on missions depend on the success of initial missions and the status of the remaining forces. The conventional tasking in the Operations Plans (OPlans) is in terms of sorties per aircraft per day, i.e., a daily sortie rate. However, the conventional tasking received by the unit in support of an OPlan would be via an Air Tasking Order (ATO) tasking the bomber force for a mission(s) consisting of some number of aircraft per mission.

In addition, the USAF WMP and unit DOC statement tasking is also in terms of sorties per aircraft per day or a daily sortie rate.

3.1.2.2 Capability Assessment. The capability assessment mechanism for strategic bomber units will be a straightforward consumption of resources per mission, sortie, or flying hour and should be identical to the fighter unit capability assessment process. Since the AFIRMS capability assessment model uses sorties, alert sorties, and flying hours in the algorithms, the capability assessment can be translated from the mission metric into one or all three of the alternate data items. In addition, because the bomber unit's resources are possessed by the bomber unit, the unit capability assessments can be aggregated into a capability assessment for higher command echelons (i.e., SAC's strategic bomber capability is the sum of the bomber units' capability).

3.1.2.3 AFIRMS Metric. The proposed AFIRMS capability assessment metrics for strategic bomber units are mission with sortie, alert sortie, and flying hours as alternate measurement metrics. The advantages and disadvantages of each metric are discussed in Section 3.6.

3.2 Air Refueling. Air refueling is a specialized task that supports strategic and tactical operations. The air refueling units support not only Air Force, Navy, and Marine units, but aircraft from other countries as well. The mission is performed by SAC, Air Force Reserve, and Air National Guard units with KC-135 and KC-10A aircraft. KC-135Q tanker aircraft are modified to refuel SR-71 aircraft and can not be used to refuel other aircraft. The KC-10A is limited to the supporting the conventional missions. In addition, the KC-10A can perform the strategic airlift mission (reference the MAC Capability Assessment Metric and MAC Requirements Analysis reports listed in section 1.4).

3.2.1 Organization and Tasking. The KC-135 air refueling squadron may be part of a bomb wing or an air refueling group/wing. The primary task of the KC-135 units is to support the bomber units in completing the SIOP tasking;

the second priority is support of the conventional missions. The primary task of the KC-10 units is to support other units in their conventional missions and are organized only as air refueling wings/groups. In addition, these units are the only SAC units with Air Force Reserve associate units. The KC-135Q aircraft support only the SR-71 aircraft and are part of the strategic reconnaissance wing.

The conventional (i.e., non-SIOP) tasking is passed to HQ SAC by the Air Force major commands and other services during peacetime and crisis. The taskings are requests for air refueling offloads to support fighter or airlift missions. The conventional tasking in the various OPlans are not as specific but are of the same form. The SIOP refueling tasking is also of the same form but is in support of SAC bomber SIOP tasking. It is not unusual for the SIOP and other tasking to exceed SAC's capability, i.e., available aircraft. In such instances, the SIOP has priority. However, if the other tasking is important enough, SAC may get permission from the OJCS to temporarily degrade the SIOP tasking.

Because of the SIOP tasking, tanker units do not deploy as a unit. Instead, a tanker task force is made up with contributions from all of the tanker units. When supporting conventional tasking, the KC-135 aircraft are subject to recall for the SIOP task. Additionally, SAC retains control of the air refueling units and SAC deploys a command echelon to task and employ the air refueling task force for the theatre commander (7th and 3rd Air Divisions are already in-place in Europe and the Pacific theatre).

In addition, the USAF WMP and unit DOC statement tasking is in terms of sorties per aircraft per day, i.e., a daily sortie rate.

3.2.2 Capability Assessment. The tasking received by HQ SAC is a requirement to offload X amount of fuel to Y number of aircraft at a specified refueling point and at a specified time. SAC does not task this pro rata requirement to its refueling units. Instead, HQ SAC converts that requirement into a number

of missions and sorties and assigns tasks to the air refueling units. A number of factors are considered in the conversion and tasking process, e.g., the tanker capacity, the distance between the tanker aircraft base and the air refueling point, the required fuel offload, etc. Thus, the conversion and tasking occur simultaneously. For example, if the tanker aircraft are close to the air refueling point, each tanker aircraft can offload more fuel and, thus, reduce the number of tanker sorties needed to complete the mission. Conversely, if the tanker aircraft must travel a long distance to the air refueling point, more tanker sorties will be needed.

The tasked sorties are based on HQ SAC estimates of the refueling units capability. Thus, the units do not typically receive levels of tasking which would require them to decide how much of it the unit can do. Instead, the units receive a "resolved" task for which they schedule the resources to complete the mission. AFIRMS will not duplicate the SAC conversion and tasking process. Rather, AFIRMS proposes to assess the tasking produced by HQ SAC and, in effect, validate the SAC estimates of the unit capability prior to the issuance of the tasking.

3.2.3 AFIRMS Metric. The proposed AFIRMS capability assessment metrics for air refueling units are mission with sorties, alert sorties, and flying hours as alternate metrics. The advantages and disadvantages of each metric are discussed in Section 3.6.

3.3 Strategic Airlift. The KC-10 air refueling units are the only SAC units that can perform the strategic airlift mission. When the KC-10 is not needed for the air refueling mission, the aircraft may fly strategic airlift missions for the Military Airlift Command (MAC). When flying the MAC airlift mission, the aircraft are under the operational control of MAC. When the aircraft is on a refueling mission, it is under SAC's control. In addition, SAC retains control on mixed airlift and refueling missions.

3.3.1 Organization and Tasking. There are two (soon to be three) squadrons with KC-10 aircraft. Two of the units will be members of an air refueling group/wing with KC-135 aircraft. One unit is a member of a bomb wing with B-52 and KC-135 aircraft. Each of the three KC-10 squadrons will be augmented with an Air Force Reserve associate squadron. None of the three squadrons are located at the same base.

A unit is not released to MAC for the strategic airlift mission. Instead, individual aircraft and aircrews are released to MAC. When released by SAC, the unit receives the airlift tasking from MAC via message. For mixed cargo and refueling missions, the tasking is given by HQ SAC but coordinated with HQ MAC and/or MAC numbered Air Force. The tasking is by mission which may contain several sorties of varying duration (i.e., flying hours). The KC-10 aircraft are not tasked for ground alert missions.

In addition, the USAF WMP and unit DOC statement tasking is in terms of sorties per aircraft per day, i.e., a daily sortie rate.

3.3.2 Capability Assessment. More analysis will be needed to determine how to assess the KC-10 airlift capability. There are three problems. First, except for the aircrew and aircraft, all of the resources used by the KC-10 on the airlift mission will belong to MAC, e.g., fuels, aerial port support, etc. Second, the unit performs mixed missions on one sortie, i.e., airlift and refueling. Last, the Air Force Reserve associate does not have aircraft; they use the active unit's aircraft. It would seem, therefore, that the reserve unit has no capability. Conversely, the active unit does not own the reserve unit's aircrews and maintenance personnel. Thus, it would seem that the active unit's capability is only half of what the two units together can do. The problem is to determine each unit's capability.

The problems of how to determine the KC-10 unit's airlift capability do not prevent the determination of the appropriate metrics. The MAC capability assessment metrics for its airlift units are mission, sorties, and flying hours

(ton-miles may be used by HQ MAC for budgeting and programming purposes). Nothing in the SAC analysis has demonstrated any reason against using those metrics for SAC airlift.

For a complete discussion of strategic airlift capability assessment, refer to the Analysis of MAC Capability Assessment report; reference j, Section 1.4.

3.3.3 AFIRMS Metric. The proposed AFIRMS capability assessment metrics for KC-10 strategic airlift units are mission with sorties, and flying hours as the alternate metrics. The advantages and disadvantages of each metric are discussed in Section 3.6.

3.4 Reconnaissance. SAC's reconnaissance assets are very carefully managed because they are very few in number, thus, making them a national asset. SAC reconnaissance units do both strategic and tactical reconnaissance. The aircraft types that perform the missions are the RC-135, SR-71, U-2, and TR-1A.

3.4.1 Organization and Tasking. Strategic reconnaissance includes worldwide tasking to gather intelligence data. The base location, aircraft status, mission schedule, and mission accomplishments are monitored at HQ SAC and the Air Staff. The daily tasking of the assets is coordinated by the Joint Reconnaissance Center and the SAC Reconnaissance Center with little or no Air Staff involvement. Because of the nature of the mission, there is no distinction in missions performed for the SIOP or for conventional tasking. Control and tasking of the strategic reconnaissance assets, i.e., RC-135, SR-71, and U-2, are retained by SAC, regardless of location. The form of the tasking is missions and does not include ground alert missions.

Tactical reconnaissance is the mission of the TR-1A squadron and it is under the operational control of the theatre commander. Crisis and exercise tasking is by Air Tasking Order (ATO) and is on a mission basis. OPlan tasking is for sorties per aircraft per day.

In addition, the USAF WMP and unit DOC statement tasking is in terms of sorties per aircraft per day, i.e., a daily sortie rate.

3.4.2 Capability Assessment. The tasked missions/sorties are based on HQ SAC (or the SAC theatre command echelon) estimates of the unit's capability. Thus, the units do not typically receive levels of tasking which would require them to decide how much of it the unit can do. Instead, the units receive a "resolved" task for which they schedule the resources to complete the mission. (In fact, the task is often coordinated with the unit before the task is assigned.)

The capability assessment will be a straightforward consumption of resources per mission, sortie, or flying hour and should be identical to fighter and bomber unit capability assessment process. Since the AFIRMS capability assessment model uses the mission sorties and flying hours in the algorithms, the capability assessment can be translated from the mission metric into one or all of the data items. In addition, because the reconnaissance unit's resources are possessed by the reconnaissance unit, the unit capability assessments can be aggregated into a capability assessment for higher command echelons (i.e., SAC's reconnaissance capability is the sum of the reconnaissance units' capability).

3.4.3 AFIRMS Metric. The proposed AFIRMS capability assessment metrics for reconnaissance units are mission with sortie, and flying hours as the alternate metrics. The advantages and disadvantages of each metric are discussed in Section 3.6.

3.5 Airborne Command and Control. The purpose of the airborne command and control unit is to provide a back up method for SAC and the national command authorities (NCA) to direct and control the strategic missile and bomber forces in the execution of the SIOP. The National Emergency Airborne Command Post (NEACP) E-4B is the principal aircraft for the NCA. The Post Attack Command Control System (PACCS) EC-135 aircraft provide a survivable command and control capability for the NCA and commander of SAC.

3.5.1 Organization and Tasking. SAC has three squadrons that perform the airborne command and control mission. (Also, the 70th Air Refueling Squadron provides some additional flight crews for the PACCS.) HQ SAC has direct tasking authority and retains operational control of all operational missions. For the NEACP units (i.e., 1st and 2nd ACCS), there are two crews: a flight crew to fly the aircraft and a "back end" crew that performs the command and control function. The "back end" crews are assigned by the OJCS and are not a part of the flying unit.

The units are only tasked to support the SIOP and the NCA. Their OPlan tasking is to maintain an orbit location (i.e., "on station") for a specified period of time. The unit then translates that orbit tasking into missions and sorties. Factors such as the distance between the orbit point and aircraft location, crew day, orbit duration, etc., will affect the number of sorties needed to maintain an aircraft "on station" at the orbit point. While the unit converts the orbit tasking into scheduled sorties, HQ SAC will have already made the same computations and does not overtask the unit. Thus, the unit does not receive "unresolved" excess tasking requiring them to decide how much of the task the unit can perform.

In addition, the USAF WMP and unit DOC statement tasking is in terms of sorties per aircraft per day, i.e., a daily sortie rate.

3.5.2 Capability Assessment. The orbit tasking is translated into missions (sorties) by the unit. While the unit's task is to maintain one or more orbits for a long period of time (perhaps indefinitely), the task of each mission is to maintain one orbit for a few hours. Thus, each mission can be assessed independently to measure the unit's capability to maintain the orbit(s). In addition, the units' capability can be aggregated to obtain a SAC capability assessment.

Since the "back end" crew do not belong to the unit, AFIRMS proposes to assess the unit's capability without the "back end" crews. It is, therefore, assumed that the "back end" resource is always available.

3.5.3 AFIRMS Metric. The proposed AFIRMS capability assessment metrics for airborne command and control units are mission with sorties, alert sorties, and flying hours as the alternate metrics. The advantages and disadvantages of each metric are discussed in Section 3.6.

3.6 The Metrics for SAC AFIRMS. Four metrics are evaluated in this report: missions, sorties, alert sorties, and flying hours. The advantages and disadvantages of each are discussed below. In reading those pros and cons, keep in mind the type of capability being measured and the AFIRMS approach to capability measurement both of which are discussed in Section 2. Also, Appendix A expands on some of the issues in determining the metrics or units of measure.

Because of the many diverse units and missions of SAC, only one of the four metrics can be used SAC-wide. The one metric is mission. Although the most popular metric is the sortie (and is already used by AFIRMS), it does not have SAC-wide or Air Force-wide applicability. For example, sorties is not a good metric for the SAC missile units or the MAC strategic airlift units. Since the sortie, flying hour, and alert sortie terms are typically used to

describe a mission, the "mission" has been selected as the prime AFIRMS capability assessment metric. Mission, as a metric, is defined in the second of the two meanings discussed in Section 3.0. Definition distinctions are expanded in the next section. Sortie, flying hour, and alert sortie are retained as alternate metrics to provide different perspectives to the capability assessments.

3.6.1 Definition of the Metrics. Some terms have more than one meaning in the Air Force (i.e., mission) and some terms are not widely used throughout the Air Force (i.e., alert sortie). The JCS Pub 1 definitions have been used and, where necessary, expanded upon. For example, the use of the word "dispatch" in the mission definition implies that a flight occurs. That has been expanded to include aircraft that have been assigned to the mission, generated for the mission, but not launched on the mission, i.e., an alert sortie. In addition, there are different kinds of alert, e.g., airborne, ground, etc. That definition has been restricted to ground alert, thus, putting the airborne alert into the sortie definition. By distinguishing between the types of sorties possible for a mission, i.e., a flying "sortie" or a ground "alert sortie," it allows AFIRMS to differentiate in the calculation of resource usage requirements and capability for each type of sortie. (Note that a mission will not mix flying "sorties" and ground "alert sorties.") It also allows the AFIRMS user to distinguish between those missions and sorties that flew and those that didn't.

- a. Mission. A mission is the dispatching of one or more aircraft (or missiles) to accomplish one particular task. An aircraft dispatched on a mission may fly one or more sorties; each sortie may one or more hours in duration. In addition, an aircraft or missile assigned to a mission may not fly but, instead, be on ground alert for the mission.
- b. Sortie. An operational flight by one aircraft (or missile).
- c. Alert Sortie. An aircraft or missile on ground alert (i.e., the sortie is generated but not launched).
- d. Flying Hour. One hour of flight by a single aircraft.

3.6.2 The Mission Metric.

Missions advantages:

- a. The units are tasked by missions. Thus, it can be directly obtained from the unit mission tasking.
- b. It is an output of the flying unit.
- c. It is a common term, well understood by all Air Force users. It is a clear concept for expressing unit readiness/capability assessments.
- d. It is the only common, SAC-wide metric.
- e. It will be common Air Force-wide.
- f. It is compatible with the AFIRMS and the Air Force Mission Area Analysis (MAA) approach to capability measurement, i.e., unit level assessments and aggregated for command level assessments.

Missions disadvantages:

- a. It is not a USAF WMP and unit DOC statement tasking metric.
- b. It is not a metric used by the Defense Guidance (DG) or Congress for programming or budgeting.

3.6.3 The Sortie Metric.

Sortie advantages:

- a. The units are tasked by missions. Thus, sorties can be directly obtained from the unit mission tasking.
- b. It is a USAF WMP and unit DOC statement tasking for all SAC units except the Strategic Missile Wings.
- c. It is an output of the flying unit.
- d. It is a common term, well understood by all Air Force users. It is a clear concept for expressing unit readiness/capability assessments.
- e. It is compatible with the fighter metric. In fact, it will be common to all Air Force flying units.
- f. It is a common metric to all SAC flying units (i.e., not to missile wings).

- g. It is compatible with the AFIRMS and Air Force MAA approach to capability measurement, i.e., unit level assessments and aggregation for command level assessments.
- h. It is the preferred metric of the SAC interviews.

Sortie disadvantages:

- a. It is not a SAC-wide metric.
- b. It is not a metric used by the DG or Congress for programming or budgeting.

3.6.4 The Alert Sortie Metric.

Alert Sortie advantages:

- a. The units are tasked by missions. Thus, alert sorties can be directly obtained from the unit mission tasking.
- b. It is an output of all SAC units with alert tasking (not for KC-10).
- c. It is compatible with the fighter metric. In fact, it is common to most Air Force flying units.
- d. It is common metric to most of the SAC units.
- e. It is compatible with the AFIRMS and Air Force MAA approach to capability measurement, i.e., unit level assessments and aggregation for command level assessments.
- f. It is a metric required by the SAC interviews.

Alert Sortie disadvantages:

- a. It would not be a SAC-wide metric.
- b. It is not a metric used by the DG or Congress for programming or budgeting.
- c. It is not a USAF WMP or unit DOC statement tasking metric.

3.6.5 The Flying Hour Metric.

Flying Hour advantages:

- a. The units are tasked by missions. Thus, flying hours can be directly obtained from the unit mission tasking.
- b. It is an output of the flying unit.
- c. It is a common term, well understood by all Air Force users. It is a clear concept for expressing unit readiness/capability assessments.
- d. It is common metric to all SAC flying units (i.e., not to missile wings).
- e. It is compatible with the AFIRMS and Air Force MAA approach to capability measurement, i.e., unit level assessments and aggregation for command level assessments.
- f. It is a metric used by the DG or Congress for programming or budgeting.
- g. Flying hours are used to compute resource usage.

Flying Hour disadvantages:

- a. It is not a SAC-wide metric.
- b. It is not a common metric for all Air Force units.
- c. It is not a USAF WMP or unit DOC statement tasking metric (for SAC units).
- d. It was the least preferred metric of the interviews.

SECTION 4. SUMMARY

In conclusion, the recommended readiness/capability assessment metric for SAC unit tasks of strategic offense, air refueling, strategic airlift, strategic and tactical reconnaissance, and airborne command and control is mission. In addition, sorties, alert sorties, and flying hours are recommended as alternate metrics since HQ SAC and HQ USAF may need them for functional views or uses in readiness assessments and dollars-to-readiness exercises. (For example, flying hours may be needed as a pricing mechanism for the dollars-to-readiness function of AFIRMS.)

The metric and alternatives for each mission task and the advantages and disadvantages of each metric are summarized below in Table 4-1 and Table 4-2, respectively.

Table 4-1
RECOMMENDED METRICS BY MISSION TASK

MISSION TASK	PRIMARY METRIC	METRIC ALTERNATES		
Strategic Offense	Missions	-	Alert Sorties	-
Missile	Missions	Sorties	Alert Sorties	Flying Hours
Bomber	Missions	Sorties	Alert Sorties	Flying Hours
Air Refueling	Missions	Sorties	-	Flying Hours
Strategic Airlift	Missions	Sorties	-	Flying Hours
Reconnaissance	Missions	Sorties	Alert Sorties	Flying Hours
Airborne Cmd Control	Missions	Sorties	Alert Sorties	Flying Hours

Table 4-2

METRIC ADVANTAGES AND DISADVANTAGES MATRIX

Advantages/Disadvantages	Mission	Sortie	Alert Sortie	Flying Hour
Advantages				
A unit tasking metric	X	X	X	X
Obtained directly from unit tasking	X	X	X	X
A USAF WMP/DOC tasking metric		X		
An output of the Air Force unit	X	X	X	X
A common term understood and used by all Air Force users	X	X		X
A clear concept for expressing readiness/capability assessments	X	X		X
Preferred/needed metric by interviews		X	X	
Has commonality SAC-wide	X			
Has commonality Air Force-wide	X			
Used to compute resource usage				X
Used in DG and Air Force budget				X
Compatible with unit level assessment	X	X	X	X
Disadvantages				
Not a WMP/DOC tasking metric	X		X	X
No commonality SAC-wide		X	X	X
No commonality Air Force-wide		X	X	X
Least preferred metric in interviews				X
Not a DG/budget metric	X	X	X	

APPENDIX A. ISSUES IN DETERMINING THE UNITS OF MEASURE.

A.1 Identifying Units of Measure. We narrowed the topic of defining the AFIRMS metric in Section 2 by noting that it must include the tasking under which the assessment occurs and by excluding factors beyond the initial launch of the aircraft. This leaves issues about the unit of measure itself. These issues include:

- Presentation of the result
- Translation from one unit of measure to another
- Levels of detail
- The user of multiple units of measure.

Each of these issues will be addressed in turn. By way of illustration, we will consistently refer to the choice of sorties as a metric made for United States Air Forces in Europe (USAFE) fighter and reconnaissance units.

A.2 Presentation of the Results. For simplicity of expression, AFIRMS has presented its assessments for USAFE in terms of sorties for readiness and in terms of a graphic multi-day plot of sorties for sustainability. Two issues related to this approach have so far been set aside in favor of more critical matters. At some future time, these deferred issues will need consideration. The two issues are:

- a. The results, especially when dealing with a large force, vary with Force Structure. This variation may require that the results be normalized to a fixed Force Structure in the future. That possibility has not been addressed in USAFE, and will not be addressed here. Final resolution of this question will require human engineering based on more data than is now available.
- b. The graphic presentation of sustainability does not provide a clear method for supporting two of the extended functions of the capability assessment carried out by AFIRMS. The extended functions are:
 - (1) Decision support. If the computer is asked to provide decision support by evaluating alternative what-if actions, it must have a clear numeric standard to evaluate. The computer cannot provide an evaluation based on the appearance of a graphic presentation;

- (2) Plots showing changes in sustainability over time. The plots of sustainability are already over time (e.g., the time from day 0 to day 30) and now another time (the calendar day on which day 0 occurs) must be shown as well.

To visualize the problem, it might help the reader to first imagine some plot over time such as that of pulse rate for each of the first 30 minutes after starting to exercise. Now add a plot of the same thing for a test conducted a week later (perhaps using color to distinguish the weeks). The point being illustrated will be clearer if the lines cross a few times. Figure A-1 illustrates a sample result using a dashed line for the test in the second week. But now if we continue to add more lines to distinguish the weeks, the results will be illegible.

It is difficult to describe or imagine a plot in which the line drawn for any one week can be clearly distinguished from, or compared to, the line for the preceding and following weeks. (A possible exception is a three dimensional graphic in which there is relatively steady change in one direction. But that is a condition on which the system designer cannot depend, even if adequate graphics are available.

Again, the best approach in these areas has yet to be humanly engineered. One suggested approach for sustainability is to simply get the sum of all sorties flown in the period. Since that is a single number plots of progress over time are no problem at all. Other single number answers are possible.

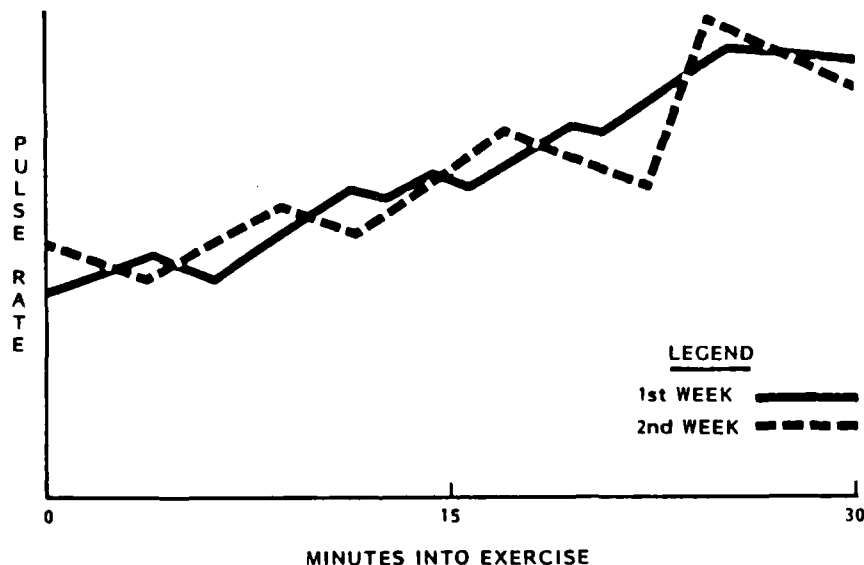


Figure A-1. Tracking Changes in Sustainability

These issues are considered to establish a complete background. The issues are relevant to the current studies in two ways:

- a. The capability assessment for Strategic Air Command (SAC) bomber and tanker units may not be compatible with the MAC airlift unit capability assessment. For example, SAC bomber and tanker aircraft normally fly their sorties from the same base and operate as part of the same wing throughout any task. On the other hand, MAC airlift aircraft normally fly most of their sorties from other bases, and are not controlled by the owning wing when away from home base. Thus, most of the airlift units' sorties are supported by several wings.
- b. The compatibility of multiple units of measure (e.g., sorties and ton-miles) displayed on the same screen is questionable. Further, even if the unit of measure were common to bombers, fighters, and airlift units, would the combined display of fighter, airlift, and bomber sorties still be meaningful? (AFIRMS has already confirmed that displaying capability assessments for many different fighter and reconnaissance aircraft with multiple missions is meaningful, e.g., an F-4 sortie is compatible with an F-111 sortie.)

Both within MAJCOMs and between MAJCOMs, careful consideration is needed to establish how (if at all) sorties can be combined with flying hours--or other types of sorties. In addition, equal consideration must be given to the use of normalized units of measure with non-normalized units of measure.

A.3 Translation From One Unit of Measure to Another. Whatever unit of measure is chosen, there are likely to be other units of measure into which it can be converted. This would occur by either:

- Measuring the resources needed to achieve the measured result (to a logistician, a sortie may look like a requirement for a given supply of fuel and munitions);
- Summing an element of the mission such as the sorties or flying hours needed to complete the mission;
- Multiplying two elements of the mission such as the tonnage carried times the distance traveled, i.e., ton-miles. (The distance traveled may be longer than the distance between cargo onload and offload. In other words, the distance traveled may also include the distance traveled by the aircraft to go to the cargo onload point and to go from the cargo offload to the next onload point or home station.)

Selecting a single metric is not to disparage any of the others. The objective is to find a metric from which many users can readily calculate the figure with which they work.

A.4 Levels of Detail. On a scale from infinitesimal detail to sweeping generalization, there is a level of detail appropriate to each level of command. Since more detailed data can often be summed to obtain the more general view, there is no need for all levels of command to use identical metrics. The only requirements are that:

- Aggregation from one level to another must be feasible.
- Each level should have a detail appropriate to its needs.

A.5 Multiple Units of Measure--The Problem of Obtaining an Overview. If, as seems probable, multiple metrics are adopted, the problem of providing a simple overview of capability may arise. References to the percent of Air Force units which are C-rated as C-1 or C-2 conceal the differences in mission of combat wings, medical units, and logistics units. Where the issue is one of detail, adding one kind of tactical fighter sortie to another, most observers will find acceptance easy. Adding fighter sorties to airlift ton-miles may not be so acceptable.

One answer is simply to say that the addition will not happen. Another is to convert all metrics to the equivalent of C-1 or C-2 and continue as though no mixing were occurring. Still a third is to assign a weight to different metrics. The problem is likely to have the greatest impact when the metrics are used outside the Air Force. Air Force personnel can recognize and assess a mix of metrics. Congress and the Executive Branch may want to answer questions such as "dollars to readiness" in a way which allows one number to stand for readiness.

The answer to this question can be and has been deferred. The existence of the question argues, however, for seeking to generalize the choice of metric wherever possible rather than to try to carefully split hairs.

END

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